A Designer Enzyme for Alternative Energy

Scientific Achievement

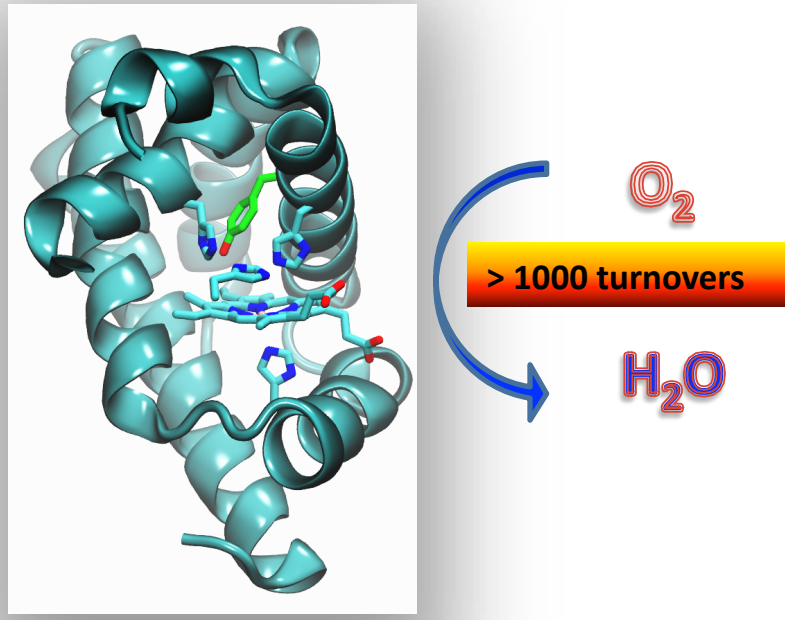
Designed an enzyme that can harvest the energy of atmospheric oxygen with high efficiency and long life

Significance and Impact

Achievement is a big step in custom designing artificial enzymes for potential applications in alternative energy

Research Details

- Introduced one tyrosine and two histidine residues into myoglobin, which yielded an enzyme that catalyzed the reduction of oxygen to water with minimal release of reactive oxygen species and more than 1,000 turnovers
- Most designed enzymes, especially ones containing metal ions, have low turnovers and efficiency, making them difficult to apply; this work is a breakthrough in designing synthetic enzymes
- Critical high-resolution crystal structures obtained at National Synchrotron Light Source



Rational design of functional enzymes with high number of turnovers is a challenge, especially those with a complex active site, such as respiratory oxidases. Introducing two His and one Tyr residues into myoglobin resulted in enzymes that reduce O_2 to H_2O with more than 1000 turnovers and minimal release of reactive oxygen species.

KD Miner, A Mukherjee, Y-G Gao, EL Null, ID Petrik, X Zhao, N Yeung, H Robinson, Y Lu, *Angewandte Chemie Int. Ed.* **51(23)**:5589-92 (2012)

Work was performed at Brookhaven National Laboratory